Crops

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Abstract

Research notes on Crops.

1 Problem Definition

Suppose there are C classes, we encode y_i by an indicator vector $p_i = \begin{pmatrix} p_{i,1} \\ \vdots \\ p_{i,C} \end{pmatrix}$, in which $p_{i,j} \in \{0, 1\}$. For example, if there are four classes, then the indicator vector $\begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix}$ represents the corrsponding label y_i as the 1st class, while $\begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$ as the 4th class.

The Crops Problem is defined as follows:
Input:
For High Res,

$$x_{t,i}^{hi} = \begin{pmatrix} x_1 \\ \vdots \\ x_d \end{pmatrix}$$

in which

$$t \in t^{hi} = \{t_1^{hi}, \ldots, t_{n_{hi}}^{hi}\}$$

For Low Res,

$$z_t^{low} = \begin{pmatrix} z_1 \\ \vdots \\ z_d \end{pmatrix}$$

in which

$$t \in t^{low} = \{t_1^{low}, \ldots, t_{n_{low}}^{low}\}$$

Knowledge:
For class c, at time t, the ideal value of high res feature is:

$$\varphi_{t,c}^{hi} = \begin{pmatrix} \varphi_1 \\ \vdots \\ \varphi_d \end{pmatrix}$$

So we have:

$$\Phi_t^{hi} = [\varphi_{t,1}^{hi} | \varphi_{t,2}^{hi} \cdots | \varphi_{t,c}^{hi}]$$

Similarly, for class c, at time t, the ideal value of low res feature is:

$$\varphi_{t,c}^{low} = \begin{pmatrix} \varphi_1 \\ \vdots \\ \varphi_d \end{pmatrix}$$

So we have:

$$\Phi_t^{low} = [\varphi_{t,1}^{low} | \varphi_{t,2}^{low} \cdots | \varphi_{t,c}^{low}]$$

Objective:

$$\min_{p_i \in \{0,1\}^C, i=1\ldots n} \sum_{i=1}^{n} \sum_{t \in t^{hi}} \|x_{t,i}^{hi} - \Phi_t^{hi} p_i\|^2 + \alpha \sum_{t \in t^{low}} \|z_t^{low} - \frac{1}{n} \sum_{i=1}^{n} \Phi_t^{low} p_i\|^2$$

s.t.

$$\sum_{j=1}^{C} p_{i,j} = 1$$

in which α is a control parameter.

(Zhu et al., 2008)

References

Xiaojin Zhu, Andrew B. Goldberg, Michael Rabbat, and Robert Nowak. 2008. Learning bigrams from unigrams. In *The 46th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL)*.